

PSEUDOCYMOPOLIA, A MESOZOIC TETHYAN ALGA (FAMILY DASYCLADACEAE)

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ABSTRACT. *Pseudocymopolia* gen. nov. is proposed for certain dasycladaceae ranging from Portlandian to Maestrichtian in age, and from Spain to Borneo geographically. *P. orientalis* sp. nov. is described, and the relationship of the genus to *Cymopolia* discussed.

IN 1959 I described a very distinctive dasyclad alga from the Maestrichtian of Iraq Kurdistan as *Cymopolia anadyomenea* (Elliott 1959). This alga showed the essential branch-structure seen in *Cymopolia*, but the calcareous segments or units were remarkable externally in swelling periodically into conspicuous annular projections or flanges: at these levels the internal branch-structure was coarser than at the inter-flange levels. These distinctive segments set *C. anadyomenea* apart from all other species of the genus, which ranges from Upper Cretaceous to Recent, but it seemed reasonable to regard the species as an early development before the very conservative morphology of the Tertiary and Recent species was achieved.

During later reporting on the algal microflora of the Bau Limestone of Borneo, random sections of an alga like *C. anadyomenea* were considered to indicate Upper Cretaceous age for the appropriate samples. This was disputed by the field-geologists, for the Bau Limestone is of Upper Jurassic and Lower Cretaceous age, and there was no evidence that the disputed samples were anomalous in position. At this point Praturlon (1964) figured a rare alga from the undoubted Lower Cretaceous of Italy as *C. aff. anadyomenea*, and Dr. Radoičić of Belgrade sent me a thin-section of Yugoslav Lower Cretaceous containing fragments of a similar alga. There is a similar record from the Lower Cretaceous of Spain (Champetier, 1967 p. 148). In re-describing *C. anadyomenea* along with other Middle East Dasycladaceae (Elliott 1968), I referred to the Italian Borneo and Yugoslav fossils as examples of 'an apparent homoeomorph' of *C. anadyomenea*.

Recently Dragastan described *Cymopolia jurassica* from the Portlandian of Rumania (Dragastan 1968). This is yet another flanged species, based on good material and carefully distinguished in detail by its author from *C. anadyomenea* Elliott and '*C. aff. anadyomenea* Elliott' of Praturlon, the two species available to him in the literature.

It is clear that these flanged forms range from Upper Jurassic to Upper Cretaceous and have a wide Tethyan distribution: Spain, Italy, Yugoslavia, and Rumania in Europe, and Iraq, Afghanistan (Kaeffer 1965), possibly Tibet (Morellet 1916; Elliott 1968, p. 40), and Borneo in Asia.

A re-examination of the relation of these flanged forms to normal *Cymopolia* spp. is facilitated by the recently described *C. eochoristosporica* (Elliott 1968). This is a key species in dasyclad evolution, for it shows an intermediate stage in the fundamental reproductive evolution of the family. The segments are of normal cymopoliform morphology in proportions and as seen externally, but the internal branches show the

transition from cladospore to choristospore organization (see Elliott 1968), making it a kind of missing link in algal evolution. This species, from Abu Dhabi in Arabia, is Maestrichtian in age. (It is not the earliest *Cymopolia* known, for the Texan *C. perkinsi* (Johnson 1968), is from the Cenomanian). In Mme Segonzac's recent review of the Pyrenean Thanetian *Cymopolia* spp. (Segonzac 1968), which reached me whilst this was being written, *C. inflataramosa* Segonzac shows a further intermediate stage between *C. eochoristosporica* and *C. elongata* (Defr.) Munier-Chalmas. This detailed study deals fully with the problem of the doubtful morphological validity of *Karrerria* Munier-Chalmas, touched on by me in describing the Middle East occurrences of *C. tibetica* Morellet (Elliott 1968), and with the varying inflation of the primary branch in and between different Thanetian and other species.

Since flanged species precede and overlap the primitive true *Cymopolia* spp. in time, it seems doubtful that they are an aberrant early development of *Cymopolia*, as was thought when only the Maestrichtian *C. anadyomenea* was known. They are accordingly referred to *Pseudocymopolia* gen. nov., diagnosed below, and the opportunity is taken to describe the Borneo species, which differs from all the other species, including those not yet fully described.

Pseudocymopolia shows fully developed choristospore organization, at an earlier geological period than the intermediate or developing choristospore structure of the Upper Cretaceous *C. eochoristosporica*. Still earlier, with *Eodasycladus* of the Lias (Cros and Lemoine 1966, 1967), the authors suggest that choristospore organization was apparently achieved by sporangial swelling of one secondary branch in each branch system i.e. a specialized form of cladospory. And Elias (1947) claimed a presumed choristospory in *Permopora* which is Permian in age, though the condition is not apparent from the figures given. Evidently the transition from cladospory to choristospory took place in different genera in different ways at different times geologically.

The relationship of *Pseudocymopolia* to *Cymopolia* is thus not necessarily close, though for taxonomic purposes both genera are placed in the Neomereae Pia 1920 (*Neomeris* appears in the Lower Cretaceous).

Genus *Pseudocymopolia* gen. nov.

Diagnosis. Thick-walled calcified dasyclad units or segments showing prominent external consecutive annular swellings or flanges: numerous crowded verticils of branches which are coarser at flange-levels; each branch showing one short primary giving rise to a globular sporangium and four or more long secondaries. Upper Jurassic to Upper Cretaceous.

Type species. *Cymopolia anadyomenea* Elliott (Maestrichtian of Iraq).

EXPLANATION OF PLATE 60

Fig. 1. *Pseudocymopolia orientalis* gen. et sp. nov. Longitudinal thin section of slightly distorted segment, $\times 40$. Lower Cretaceous, Bau Limestone; Tebedu Road, Tubiti, Kuching, Sarawak, Borneo. Syntype, reg. no. V.54126.

Fig. 2. *Pseudocymopolia orientalis* gen. et sp. nov. Oblique transverse thin section through terminal thickening of slightly crushed segment, to show branch-structure, $\times 40$. Same locality and horizon. Syntype, reg. no. V.54127.



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